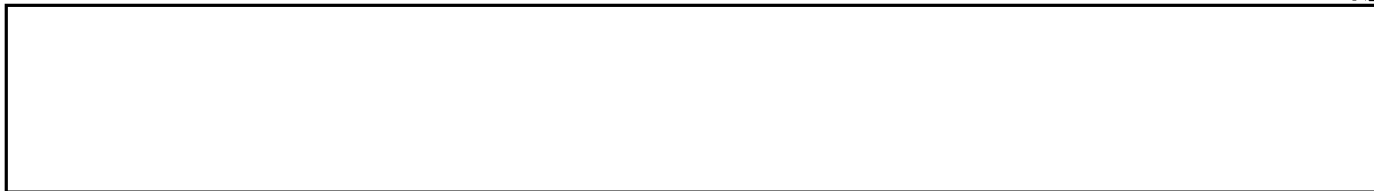


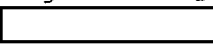
SECRET

Copy No. C of a-e

25X1



December 4, 1970

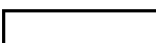
To: John C.
 From: 
 Subject: Technical Progress Report No. 7
 Contract No. 
 Reference: /2201201-TPR-7

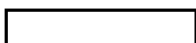
25X1

25X1

25X1

Declassification Review by NGA/DoD

This is the seventh monthly technical progress report on Contract No.  covering the program effort from 20 October 1970 to 20 November 1970.

During this month the developments of the previous months effort have yielded several significant results. One of the primary objectives of this program has been to develop and apply optical image manipulation capabilities to the operational image, and to demonstrate that the technology is applicable and can provide an increase in information extractability. We initiated this program using microscope optics at the  lab, applying developments in optical systems analysis. Using laboratory prepared targets we refined methods to control system response parameters. At three months into the program we initiated similar activity at the customers laboratory. During the past month we were able to apply the technology to operational material, and information extractability gains were conclusively demonstrated.

Also during this past month a description of the optical systems analysis was written up. This document will be delivered during the coming month as a technical memorandum under this contract.

GROUP 1

EXCLUDED FROM AUTOMATIC
 DOWNGRADING AND
 DECLASSIFICATION

SECRET

NOTICE

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, USC, SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

The computer synthesis of filters was initiated and programming is now being performed. We are using this approach to gain accuracy and flexibility in the high frequency enhancement filters being applied at the laboratory. A first set of vacuum evaporated low frequency attenuation filters was received and is now being applied on the microscope. The objective is to obtain lower system noise levels with these filters rather than with silver density filters. 25X1

Results obtained from the in-line optical processing systems for complex aberrations have been very good. Imagery which had alpha-numeric information spuriously resolved was reconstructed, gaining intelligible information at the output.

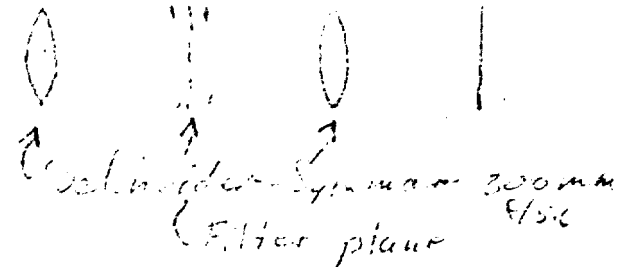
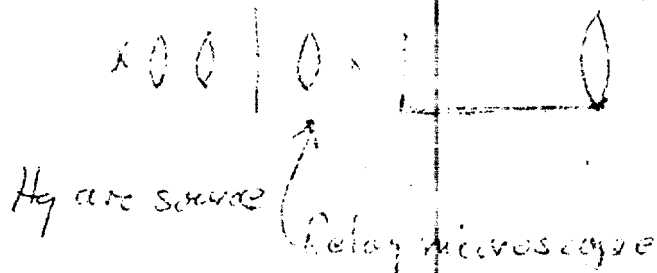
During this coming month we will be presenting a briefing at the customers facility to describe the status of the program. This program has been much more progressive than originally anticipated and the results demonstrate the significance of optical image manipulation as an important tool for information extraction from operational material.

25X1 Attached to this report are carbon copies of the laboratory notebook used by personnel for customer lab applications.

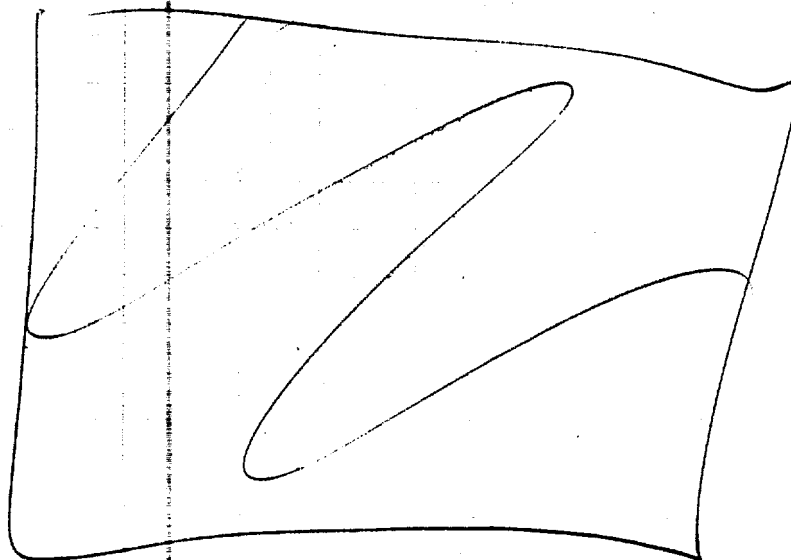
SECRET

Subject

System diagram



Liquid in filter plane
Tetra chloroethylene C₂Cl₄
Fisher Reagent Cat No C-182
 $n = 1.5055 @ 20^\circ C$



System
Photo

SECRET

ILLEGIB

Approved For Release 2005/11/21 : CIA-RDP78B05171A000500020093-1

Next 1 Page(s) In Document Exempt

Approved For Release 2005/11/21 : CIA-RDP78B05171A000500020093-1

SECRET

Subject

Notes

Op 19 is clearly visible - compare to original
Op 15 is sometimes " Not so on original

4 mm dia. filter gives sharper image.

Exp # 12 appears best of all.
Op. 15 visible.

Roll I Because of liquid gating problems the
last series of photos were repeated.
However these came out defocused.

We selected a number of potential
images for image processing, based
on 30 x prints.

Program Plan written to conclude
effort applied to CORN

SECRET

SECRET

Subject

Instructor's Name

ILLEGIB

Oct. 28, 1970

Conditions for best results

Condition 1

1.5 mm.

Source

4 mm +

Filter

4 mm
1.5 D

Condition 2

Source

2 mm.

Filter

4 mm.
1.2 D

for the CORN target image.

Original Ep 15 comes through clearly

Processed - lower freq. groups much
higher contrast +
gp 15 possibly returned

+ Source slightly underfilled the filter.

SECRET

ILLEGIB

Approved For Release 2005/11/21 : CIA-RDP78B05171A000500020093-1

Approved For Release 2005/11/21 : CIA-RDP78B05171A000500020093-1

SECRET

Date

Subject

Instructor

R.11 1
a) with pdr 4, 8, 16, 32, 64 seconds
b) w/o " 14, 16, 32, 64 seconds

Film processed HC 110 2 parts fixed
4 parts HC 110
9 minutes @ 68°F

Roll 1 @ 69.5°F

Roll 2 3. refocusing, repeat of Roll 1.

Roll 3 liquid gate replenished & dropper
focus checked, no adj. required

Roll 4 & Roll 5
no refocusing or
liq. gate repl.

Processing of rolls 2-5 incl. at 69°F,
9 min., agitation every 30 sec for
2 sec.

SECRET

SECRET

Subject _____

Instructor's Name _____

Method, processing of input -
 processed output
 unprocessed output

with D wedge (0.087 d/s) unprocessed
process

Roll 1	2A	16	7A	14	A+
1	4	14	8	11-13	C
1	5A	13-14	9A	12-13	D
1	3	14	17	13-14	E
1	5A	15	7	12-13	B

+ TC reference at

It appears best results obtained with Roll 1 - after initial set-up of system.

Could be mechanical position change from
 a) cradles on camera plane to film
 was changed.

b) surface tension of object plate liquid
 could possibly alter the position.

SECRET

SECRET

ILLEGIB

Subject

Instructor's Name

Test exposure series

- 2 mm spot (source dia) 18002 ppi
- A) No filter $\frac{1}{15}$ sec $\frac{1}{4}$ 1 $\frac{1}{10}$ 10
- B) With 0.8 D, 4 mm dia filter same source
- C) With 0.8 D $\frac{1}{2}$, 4 mm dia $\frac{1}{4}$ sec 2 min. Source at same dist. 1X. Same exp. as B.

Processed in HCl - best exp. undistorted.
 It looks as if the Pan X film is limiting the quality of the output.

Placing a 1st transform lens into system - about 4" f -
 to give ans 3X enlarged output -

SECRET

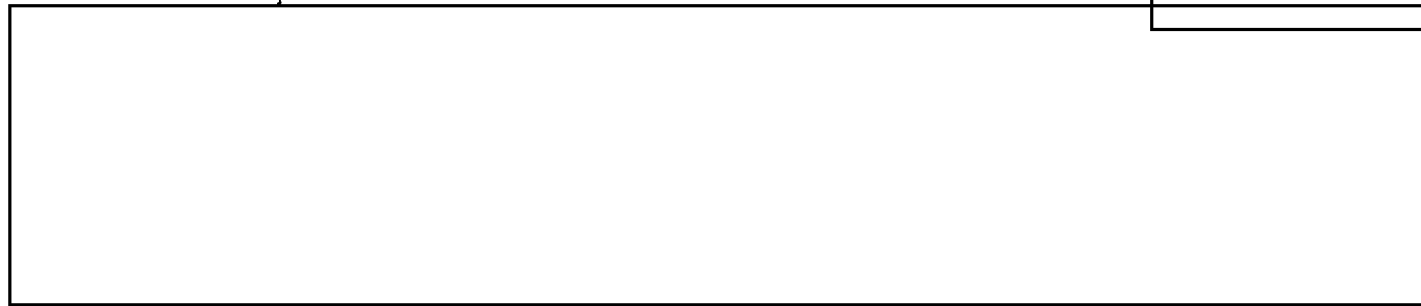
705. Cassin!

SECRET

Subject

Instructor's Name

ILLEGIB



System magnification 3.23 X

Second line F = 300 mm

So First line = $\frac{300}{3.23}$ mm



25X1

Nov. 12, 1970

⇒ Review of CORN target imagery and micro. traces. Reduction job to be performed as soon as original inputs are traced.

⇒ Review of results obtained during past week --- There is a problem of fogging, i.e. granularity. This is with the system operating at 3X.

SECRET

SECRET

a

system set-up @ 1:1

High contrast res @ C #3 (small spot size)
 @ C #6 (med. spot size)
 @ C #3 (large in it)

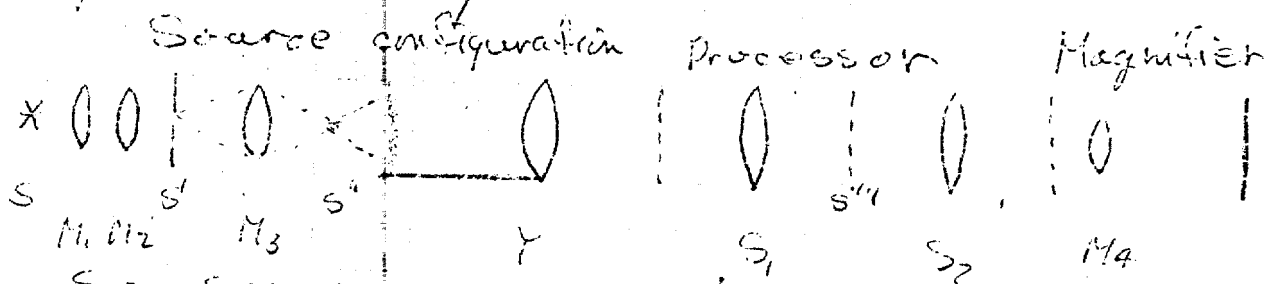
with large diffused spot;
 viewed with 6x obj, 10x eyepiece

b

small spot $\approx$ C #3

large spot 6-5 to 6-6

System Configuration



S = source or source images

M = microscope objectives

Y = yaeger collimating lens

S = Schneider processing lenses

Exposure series with "bird" in format.
 2 mm dia spot image

(A) 1/8, 1/4, 1/2, 1, 2, 4 sec without filter

(B) 1, 2, 4, 8, 16, 32 sec with 0.8, 4 mm d. filter

(C) 4, 8, 16, 32 sec with 0.8 d. filter
 of 4 mm dia lens
 with source @ 4 mm.

SECRET

SECRET

Nov 12, 1972 25X1

Date

I

Notes
Requirements for change of system, config.

- 1) CC lens over front of camera, as if due to halation total
- 2) Strong spot (another halation?) or cluster.

Concl. First lens causing problem although it helped in obtaining greater resolution.

The above exposures should help decide whether alteration improved situation. We need to evaluate the continuous film images and when we alter the system we should do so with one variable at a time to maintain control of the parameters.

At this time we should utilize the working aspects of the processes with which we got good results on the CCRS imagery.

When we have done our best with the present system we should alter magnification — essentially increase optical resolution of the camera — maintaining all other parameters equal.

Results

There appears to be a crisp delineation between processed & unprocessed imagery. To repeat with a smoothing filter — a low pass filter.

SECRET

SECRET

Date _____

Focus appears critical and must
be monitored closely.

Series 1

4 mm dia, 0.80 fibers

11. 11. 1940

2 processing lens at 1/8, 1/22, 1/32

Exposure times "Bird" photo
1/1000 sec

② 4/5.6

8/22 1, 4, 8, 16, 32, 64

$\frac{1}{32}$	1	4	8	16	32	200
----------------	---	---	---	----	----	-----

Visual notes

Visual notes
at $f_1 = 2$. Granularity of output goes down.

~~SECRET~~

Subject

SECRET

Series 2

Low contrast target cards

A) no filter - L₂ @ ~~1/16~~ ^{at 1} 1/32
exp 1/8, 1/4, 1/2, 1, 2 secB) 0.80 filter, 4mm dia., L₂ @ 1/32
exp 1, 4, 8, 16, 32 secC) next high D filter, 4mm dia., L₂ @ 1/32
exp 2, 8, 16, 32, 64 secSource maintained at 4mm dia.
Focus checkedResults

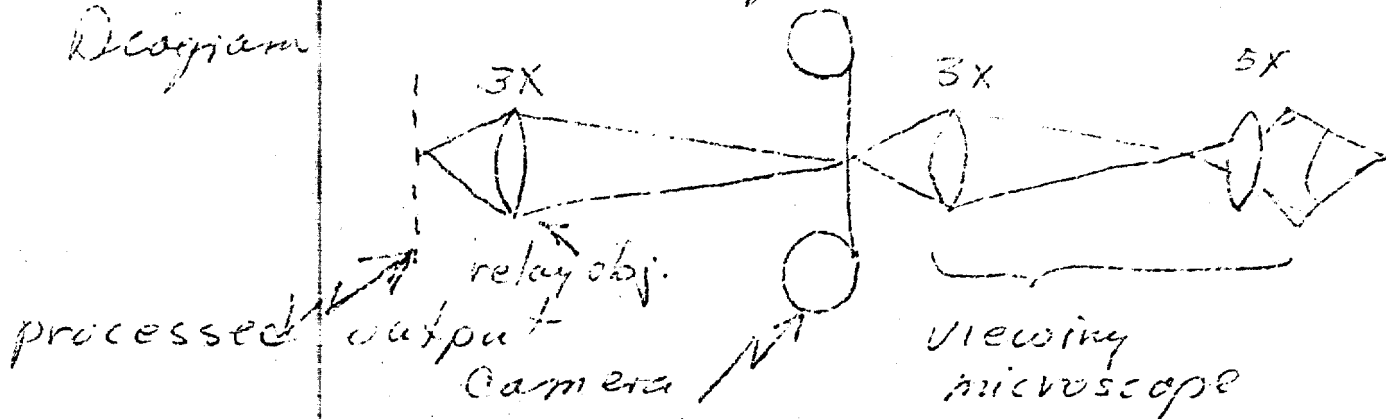
no detail in scene that was
passed through magnifying component,
only edges roof's in and they
don't have much detail to go on.

⇒ "The Bird", Series 1 looks
very good!

SECRET

Method of checking out focus

Diagram



All these components are locked together — and advanced or backed off with a micrometer screw. The film plane, defined by a glass reticle at that position, is viewed through the microscope and when the processed output is in best focus (determined by resolving grain structure) the components are locked in. Objectives are working at standard microscope tube lengths.

Subject

SECRET

Series 3

This series is being taken because after viewing output there appeared to be less granularity with second filter D than with 0.80, and greater sharpness with L2 with open @ f/5.6.

so to look at imagery with second D filter, 4 mm dia. — 2 mm & 4 mm dia.

source.

Row of houses — low cont.

(A) No filter 9 mm spot dia. L2 @ f/5.6
exp 1/8, 1/4, 1/2, 1, 2 sec

(B) high D filter 7 mm spot dia L2 @ f/5.6
exp 1, 2, 8, 16, 32 sec

(C) Same as B except 2 mm spot dia.
exp 2, 4, 8, 16, 32, 64 sec

Focus checked out.
Liquist gte " "

Subject

SECRET

Processing of Roll III
 4C115 1 part to 2 parts H2O

69°F, agitation 10/30 sec
 15 sec each 60 " then

John will evaluate this imagery.

Nov. 19, 1970

John at class this a.m.

Review of latest films in his book
 reflect "ringing" and "graininess" of
 imagery. I think that this is because
 of the high densities being used as filters.

Roll 1

Objective: - To smooth out grainy
 appearance by a) soft source,
 fluorogen and (b) low pass filter
 at output relay lens (quartz)
 and c) a low freq. attenuation filter.
 Variable in this series is (b), to see
 where it becomes effective.

Exposures 0.80 filter 9mm dia; Sound
 at 4mm dia.

Iris pos'n

1 (closed) exp time 2, 4, 8, 16, 32 sec
 2 opening 1/2, 1, 2, 4, 8, 16 "

SECRET

Subject

SECRET

Inst

Roll 2 iris pos'n #4 1, 2, 4, 8, 16 sec.

Result: Visually the resolution drops off at iris pos'n #1. The "noise" drops off (smooths out). As the iris is opened the speckle increases with the resolution.

Roll 2 cont. J. Objective: Selecting iris pos'n #2 based upon good output, visually assessed. To evaluate various source sizes, parameters using 4mm dia paper S.E.D. It is expected that the soft focus is best for continuous tone images, and that when hard edges are used it causes ringing. This requires determining whether filter should be overfilled or can be underfilled.

Variable — Source image diameter

Source image dia.

a) ~ 1.5 mm exp 2, 4, 8, 16, 32 sec.

b) ~ 2.5 mm 1, 2, 4, 8, 16 sec

c) ~ 6.0 mm 1/4, 1, 2, 4, 8 sec

d) ~ 4 mm 1, 2, 4, 8, 16 sec

SECRET

SECRET

Subject

ILLEGIB

Review of some imagery taken by John on 11/18/75. A number of scenes are present on the side of the casing of a "bird". This number of scenes through a clearly in some of the processed imagery. We'll have to check this out against the original to see if we have improved the output. This result is best on the last scene. Run out through using lower density attenuation papers.

In general I think that different system candidates that often one wants to get binary detectors. With one wants to get smooth antipodes for imagery. Greater edge enhancement, perhaps, which in case of noiseless, high smoothing filters may compensate for that.

SECRET

Subject

SECRET

Instructor

Roll 4

What is a good filter - source
configuration, recording other areas
of format for various opportunities.

A) T 1.10, 4 mm filter, 4 mm source area.
aperture 1, 2, 4, 8, 16 sec.

B) no filters, same 1/30, 1/8, 1/2 sec.
area as B.

C) new area, with filter ^(no are in without filter) 1/2, 1/4, 1/8 sec.

D) another " " 2, 4, 8 sec.

Roll 5 A) Repeat of D. 2, 4, 8 sec

B) Another area 1/8, 1/4, 1/2 sec.

C) Another " 1/2, 1/4, 1/8 sec.

D) " " 2, 4, 8 sec.

For 20, 1970

1. Demonstration to H.P. of an apparently permanent result.
2. Demonstration to F.F. of this result, comparing to disc position that was actually processed through the optical system.

SECRET

SECRET

Subject _____

Instructor's Name _____

3. Demonstration to N.G., as shown to F.T.

The only conclusion that can be taken at this time is that expected from analysis and from previous results with CORN target imagery. That is that contrast of high frequency info. can be increased, effectively reducing output threshold and increasing apparent resolution.

25X1

Optical system evaluation

Dec. 1, 1970

System tolerances were investigated.

First series of exposures

Focus
&
Exp.

- a) focus @ 16 $\frac{1}{2}$, 1, 2 sec exp. $\rightarrow$ visually set as best focus
- b) @ 20 $\frac{1}{2}$, 1, 2 sec
- c) @ 12 $\frac{1}{2}$, 1, 2 sec

Visual monitor of beam output showed a & c were better focus pos'ns than b.

SECRET

BEST COPY
Available